



WINNER

1999 R&D 100 Awards Winner

Atmospheric-Pressure Plasma Jet (APPJ)

Features

The Atmospheric-Pressure Plasma Jet (APPJ) produces a high-flux gas stream of reactive chemical species that can clean, decontaminate, etch, or coat surfaces—at atmospheric pressure and low temperature. Until now such plasma treatments could take place only in vacuum. Spraying surfaces in the open air, somewhat like a fire extinguisher, the plasma jet can convert a vast range of organic residues or toxins into water vapor, carbon dioxide, and other nontoxic gases—in a minute or less. And unlike other atmospheric-pressure plasma sources, whose high temperatures limit their use to indiscriminate “burning” rather than selective chemical reactions, the plasma jet’s gas stream is cool enough to treat paper without scorching it.

Applications

- Cleans the steel draw rolls used to produce nylon
- Deposits silicon dioxide films onto plastics and other materials
- Removes photoresist from silicon wafers
- Etches polyimide, tungsten, tantalum, silicon, and silicon dioxide
- Makes teflon wettable so it can bond with other materials
- Removes graffiti
- Decontaminates surfaces exposed to chemical or biological warfare agents or surfaces containing radioactive materials
- Has potential for sterilizing food-processing and medical equipment, restoring art, and cleaning clothes and carpets

Benefits

- Cuts time and cost and eliminates solvents in cleaning the steel draw rolls used to produce nylon or in processing semiconductor wafers
- Could improve the taste and shelf-lives of foods and beverages stored in plastic containers
- Removes graffiti without damaging underlying surfaces
- Allows equipment contaminated with chemical or biological warfare agents to be reused or contaminated areas to be reinhabited
- Concentrates removed radioactive waste into a small filter